

**Radio Shack**



**ALGEBRA I PROGRAM**

**Radio Shack**

**TRS-80**

**ALGEBRA I  
PROGRAM**

**User Instruction Manual**







ADDENDUM  
TRS-80 - ALGEBRA I  
CAT. NO. 26-1702

ALGEBRA I IS A LEVEL I PROGRAM, AND CANNOT BE USED ON A LEVEL II COMPUTER WITHOUT SOME MODIFICATIONS. YOU MUST FIRST LOAD THE CONVERSION TAPE, THEN LOAD THE PROGRAM TAPE AS INSTRUCTED IN THE MANUAL (AT LEAST 16K OF MEMORY IS REQUIRED IN LEVEL II). WHEN THE CONVERSION IS COMPLETE, DO NOT RUN THE PROGRAM BUT USE THE EDIT FUNCTION TO MAKE THE FOLLOWING CHANGES (ALL EXCEPT ONE LINE ARE LINE REVISIONS):

LESSON 1 - - - - - NO CHANGES REQUIRED

LESSON 2 - - - - - NO CHANGES REQUIRED

EXERCISE - - - - - NO CHANGES REQUIRED

LESSON 3 - - - - - NO CHANGES REQUIRED

EXERCISE - - - - - CHANGE AND ADD LINES TO READ AS FOLLOWS:

```
235 PRINT " -30-":PRINT@495, "":FORA=7TO30:SET(11,A):NEXTA:SET(10,29):SET(10,30)
240 SET(12,29):SET(12,30):INPUTZ:FORA=7TO30:SET(11,A):NEXTA:SET(10,29):SET(10,30)
250 SET(12,29):SET(12,30)
```

LESSON 4 - - - - - CHANGE LINES TO READ AS FOLLOWS:

```
150 PRINT " 1) 2 ** 6 = N    N=":PRINT:PRINT " 2) 2 ** N = 32    N=
160 PRINT:PRINT " -3) N ** 3 = 27    N=":PRINT@596, "":INPUTX:PRINT@724, "":INPUTX
170 PRINT@852, "":INPUTX:PRINT@896, "THE CORRECT ANSWERS ARE 64, 5 & 3."
```

LESSON 5 - - - - - CHANGE LINE TO READ AS FOLLOWS:

```
310 PRINT@218, "":INPUTX$:PRINT@346, "":INPUTX$:PRINT@474, "":INPUTX$
```

EXERCISE - - - - - CHANGE LINES TO READ AS FOLLOWS:

```
120 PRINT "YOUR ANSWERS. ":PRINT "1) 3X - Y = 21    X=":PRINT:PRINT " 2X + Y = 4    Y="
130 PRINT:PRINT "2) 3X + 5Y = 11    X=":PRINT:PRINT " 2X - Y = 16    Y="
140 PRINT:PRINT "3) 3X = 27 - Y    X=":PRINT:PRINT " 2Y = 3X    Y=":PRINT@148, "":INPUTU
150 PRINT@276, "":INPUTV:PRINT@404, "":INPUTW:PRINT@532, "":INPUTX:PRINT@660, "":INPUTY
160 PRINT@788, "":INPUTZ
170 IFU=5PRINT@156, "CORRECT":GOTO190
180 PRINT@156, "WRONG. X="
190 IFV=-6PRINT@284, "CORRECT":GOTO210
200 PRINT@284, "WRONG. Y="
210 IFW=7PRINT@412, "CORRECT":GOTO230
220 PRINT@412, "WRONG. X="
230 IFX=-2PRINT@540, "CORRECT":GOTO250
240 PRINT@540, "WRONG. Y="
250 IFY=6PRINT@668, "CORRECT":GOTO270
260 PRINT@668, "WRONG. X="
270 IFZ=9PRINT@796, "CORRECT":GOTO290
280 PRINT@796, "WRONG. Y="
290 IFUC>5PRINT@163, "":INPUTU
300 IFVC>-6PRINT@291, "":INPUTV
310 IFWC>7PRINT@419, "":INPUTW
320 IFXC>-2PRINT@547, "":INPUTX
330 IFYC>6PRINT@675, "":INPUTY
340 IFZC>9PRINT@803, "":INPUTZ
```

LESSON 6 - - - - - NO CHANGES REQUIRED

EXERCISE - - - - - NO CHANGES REQUIRED

NOTE: AS A REMINDER, THESE REVISIONS WILL SUCCESSFULLY CONVERT THE PROGRAM FOR 16K LEVEL II COMPUTERS ONLY.

**ALGEBRA I**

**TRS-80  
MICRO COMPUTER  
SYSTEM**

**Catalog Number:  
26-1702**

## INTRODUCTION

These Algebra I programs may be used by teachers and students as a supplement to an existing course of instruction or they may be used by other groups seeking to refresh their knowledge of algebra. The programs can also be used in business environments to help employees advance and become more productive and useful to the company. They will also benefit the individual who is seeking to learn algebra through self instruction at a leisurely pace. Algebra I is designed to provide the fundamental basics of algebra and to make learning it enjoyable.

You should notice that computer math symbols are not always the same as textbook math symbols. For instance, the computer does not use the divide-by symbol ( $\div$ ); it uses the slash symbol (/) instead. It also does not use the letter X as the multiplication symbol. Multiplication is determined when factors are shown as  $(a, b)$ ,  $a, b$  or  $(a + b), (a - b)$ ; the arrow shows normal placement of a multiplication symbol. Exponential numbers (the power of a number) are also uniquely utilized by the computer. In textbook math, the square of the number 2 (2 to the second power) is written  $2^2$ ; in the computer, it is written  $2 ** 2$ ; or, 2 to the third power ( $2^3$ ) is written  $2 ** 3$ .

Refer to the User's Manual For Level I to review fundamental "must" operations for computer usage.

## PREVIEW OF ALGEBRA I LESSONS

Lesson I addresses definitions of variables, constants, terms, expressions and use of parentheses. For a quick look, before checking out the program, you may want to review the following:

- a variable is a letter or symbol that represents any number in a specified set of numbers. For instance, you may assign  $x$  as the variable to represent any number between 1 and 99.
- A constant is a letter or symbol that represents only one number. Therefore, if a variable,  $y$ , can have only one value, it is treated as a constant.
- A term is a number or variable, or it is the product or quotient, of numbers and variables. You may consider 3,  $5(x)$ ,  $9ab$  etc. as terms.
- Expressions consist of one or more terms connected by a plus or minus sign. The terms  $xy$ ,  $2xy + 3$  and  $xy - 3$  are expressions. Notice that  $xy$  is not preceded by a plus or minus sign but, since no sign is used, it may be read "+  $xy$ ".
- Parentheses ( ) are used to treat an expression as a single number. Thus,  $3(a + b)$  means three times the sum of  $a$  and  $b$ .
- To evaluate an expression is to find its value for given values of the variables. For example, to evaluate  $3(x + y) + 3y - x/3$  if  $x = 9$  and  $y = 3$ , you must do the following:
  - 1) Substitute the value for each variable 1)  $3(9 + 3) + 3 \cdot 9 - 9/3$
  - 2) Evaluate expressions inside parentheses 2)  $3 \cdot 12 + 3 \cdot 9 - 9/3$
  - 3) Do multiplications and divisions in order 3)  $36 + 27 - 3$
  - 4) Do additions and subtractions from left to right 4) answer 60
- In order to use algebra to solve problems, you must be able to represent verbal expressions algebraically. The verbal expression, "The product of  $x$  and  $y$  increased by  $z$ " is represented algebraically as  $xy + z$ .

Lesson II concerns equations and how to solve them. An equation is a statement that two expressions are equal, such as  $2y = 8$  or  $2x + 3y = 15$ . To solve an equation, you must find the value of the variable, which, when substituted in the equation, results in both sides of the equation being equal. So, in the equation  $2y = 8$ , the variable  $y = 4$  since it is the only value that can make both sides equal (or satisfy the equation). The value, '4', is also the *root* of the equation because no other value would make the equation a true statement. This lesson also provides the rules for solving equations and steps for problem solving. After you have gotten this far, the computer tells you to type CLOAD (and press ENTER). This loads some exercise problems into the computer for your practical part of the lesson.

Lesson III discusses real numbers, both negative (represented by a minus sign) and positive (represented by a plus sign or by no sign). The number zero, together with positive and negative numbers, are called real numbers. Any positive number is greater than any negative number because a positive number is greater than zero and a negative number is less than zero.

Positive and negative numbers represent quantities that are the opposite of each other. In any pair of opposites (+40 and -40, +20 and -20, etc.) the positive of the pair is the absolute value of each of the numbers. The absolute value symbol is a vertical line ( | ) preceding and following the value. Thus the absolute value of 40 is written |40| (notice that the computer does not contain the absolute value symbol, so it substitutes the capital i [ I ] . Thus, the absolute value of  $x$ , for instance, appears as |x|).

This lesson also gives the rules for adding, subtracting, multiplying and dividing signed numbers.

For more on Lesson three, load the remainder of the program into the computer (type CLOAD and press ENTER).

You will now be provided additional information on positive and negative real numbers and their representation on the number line.

The final part of this lesson consists of word problems and exercises.

Lesson IV covers repeated multiplication of factors, powers of signed numbers, multiplying numbers of the same base, negative exponents, division of powers and provides exercises for this lesson.

The instructions describe how to arrive at the exponent (the power) of a factor (which is multiplied repeatedly) such as  $3 \cdot 3 \cdot 3 \cdot 3 = 81$ . The base, 3, is repeated four times. Thus, 81 is the fourth power of 3 and is written as  $3^4$ . The number 4 is the exponent.

The rules for finding powers of signed numbers state that:

- for a positive base, the power is always positive. Example:  $(+2)^3 = +8$  since  $(+2)^3 = (+2)(+2)(+2)$
- for a negative base, the power is positive when the exponent is even and negative when the exponent is odd. Thus  $(-2)^2 = +4$  and  $(-2)^3 = -8$  since  $(-2)^2 = (-2)(-2)$  and  $(-2)^3 = (-2)(-2)(-2)$ .

In multiplication of numbers of the same base, the common base is kept in the product and the exponents are added. So,  $(2^2)(2^3) = 2(2+3) = 2^5 = 32$ .

To find the power of the power of a base, keep the common base and multiply the exponents. Thus,  $(x^4)^3 = x^{12}$  since  $(x^4)^3 = (x^4)(x^4)(x^4) = x^{4+4+4} = x^{12}$ .

Negative exponents are discussed briefly:

The expression,  $x^{-2}$  means  $1 \div (x^2)$ . Thus,  $3^{-2} = 1 \div (3^2) = 1/9$ .

When dividing powers having the same base, the common base is kept in the quotient and the exponent is found by subtracting the exponent of the divisor from the exponent of the dividend. For example,  $x^a \div x^b = x^{a-b}$  (if  $a$  is larger than  $b$ ).

The lesson ends with a few important exercises.

Lesson V tells you how to solve a system of equations and introduces you to formulas, using the knowledge you have acquired in the previous lessons.

Lesson VI provides instructions on factors, factors of expressions with more than one term and, factoring and solving quadratic equations by factoring.

Consider an expression with one term,  $ab$ . The term,  $ab$ , is the product of  $a$  and  $b$ . In this example,  $a$  and  $b$  are called factors of  $ab$  just as 3 and 5 are the factors of the product 15.

In factors of expressions with more than one term, such as  $8ad - 8abc$ , you'll notice that both terms have the common factors 8 and  $a$ . The greatest common factor is  $8a$ , the product of the common factors. You may now write the expression  $8ad - 8abc$  as  $8a(d - bc)$ .

Factoring is the process of finding the factors of an expression. The expression is the product of its factors. Thus, if you were to factor the expression  $x^2 + 6x + 5$  then:

$$\begin{aligned} & x^2 + 6x + 5 \\ &= x^2 + 5x + x + 5 \\ &= x(x + 5) + x + 5 \quad \text{--- } x \text{ is a common factor in the first two terms.} \\ &= x(x + 5) + 1(x + 5) \\ &= (x + 5)(x + 1) \quad \text{--- since } (x + 5) \text{ is a common factor then } x^2 + 6x + 5 = (x + 5)(x + 1). \end{aligned}$$

A technique commonly used in factoring is based on the rule that the same term (or terms) may be added to and subtracted from an expression without changing it.

A quadratic equation in one variable is an equation in which the highest power of the variable is the second. Thus,  $x^2 + 3x + 2 = 0$  is a quadratic equation in  $x$ . Every quadratic equation has two roots. For example:  $x^2 = 16$  has two roots, 4 and  $-4$ .

To solve quadratic equations by factoring, you may follow this rule: If the product of two factors is zero, then either one of the factors must equal zero. Then, if  $x(x - 2) = 0$ , either  $x = 0$  or  $x - 2 = 0$ .

Example:

$$\begin{aligned} & \text{Solve } x^2 - 3x + 2 = 0 \\ & \text{or } x^2 - 2x - x + 2 = 0 \\ & \text{or } x(x - 2) - 1(x - 2) = 0 \\ & \text{or } (x - 2)(x - 1) = 0 \\ & \text{so } x - 2 = 0 \text{ or } x - 1 = 0 \\ & \text{thus } x = 2 \text{ or } x = 1 \end{aligned}$$

This lesson too, ends with a short series of exercises.

## SUMMARY

You have seen an overview of the Algebra I programs and now it's time for you to put them to use. If you are presently an Algebra student, you more than likely have a textbook that complements our programs. If you are not presently enrolled in an Algebra course, you may be able to check out an Algebra textbook from your local library or, if you like, purchase one at your local book store.

We think that you'll like the computerized course we have designed. There is no hurry — you can set it aside for today and come back to it tomorrow. You can review any lesson at any time you wish. Have fun learning at your own pace.

All Radio Shack computer programs are distributed on an "AS IS" basis without warranty.

Radio Shack shall have no liability or responsibility to customer or any other person or entity with respect to any liability, loss or damage caused or alleged to be caused directly or indirectly by computer equipment or programs sold by Radio Shack, including but not limited to any interruption of service, loss of business or anticipatory profits or consequential damages resulting from the use or operation of such computer or computer programs.

**NOTE:** Good data processing procedure dictates that the user test the program, run and test sample sets of data, and run the system in parallel with the system previously in use for a period of time adequate to insure that results of operation of the computer or program are satisfactory.

Refer to User's Manual for warranties. Failure to adhere to procedures set forth in User's Manual may result in the loss of warranties.

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